Job Impacts in New Hampshire From Construction of the Proposed Northern Pass High-Voltage Transmission Line

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polecon research

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PolEcon Research was commissioned by the New England Power Generators Association to analyze the employment impacts of the proposed construction of the Northern Pass Transmission Project. Although commissioned by the New England Power Generators Association, this report was prepared independently. PolEcon chose all data and methods used in the analysis. PolEcon presented this report to the New England Power Generators Association without advance notice of the results. PolEcon agreed to make editorial changes in the report and to correct any errors of fact but did not make any changes to the results or conclusions of the analysis unless an error of fact, data or calculations could be demonstrated. All interpretations of data, conclusions, and any errors contained in the report are the responsibility of the author and not the New England Power Generators

Executive Summary

This report is an independent, quantitative assessment, using standard economic models and methods to document the job impacts in the State of New Hampshire resulting from the proposed Northern Pass high-voltage transmission line project. To develop comprehensive and accurate estimates, prior studies of high-voltage transmission line construction projects throughout the country were reviewed, capital cost models for electric generation and transmission were consulted, and an analysis of the availability of qualified businesses and workers in New Hampshire capable of meeting the project's expected demand for goods and services was conducted.

Results of this analysis indicate that the job impacts associated with the proposed transmission line project will be substantially lower than estimated in Northern Pass Transmission, LLC studies. Our estimates of job impacts range from a high of 533 (485 on a full-time equivalent basis) in year two, to 241 (219 on a full-time equivalent basis) in year one and are less than one-half of the estimates presented in studies issued by Northern Pass Transmission (NPT). Adding the impacts related to spending by out-of-state construction workers (impacts that are not estimated in NPT studies), job impacts are still only one-half as large as those estimated by NPT.

The combined job impacts in New Hampshire resulting from both Northern Pass project expenditures in the state and the spending by out-of-state construction workers is expected to increase forecasted job growth in New Hampshire by about one-tenth of one percent. Despite a large overall cost of completing the project, the New Hampshire economy does not have enough of the required business inputs or specialized labor to complete the project without a majority of inputs from out-of-state businesses and labor. New Hampshire businesses and workers will capture no more than 11 to 19 percent of project related expenditures.

Evaluating the benefits and costs to state residents of a large, high-voltage, power line in the State of New Hampshire requires a more open and thorough assessment of potential benefits than has been provided to date by proponents of the project. Transparent methods, models, and assumptions, using publicly available data that allow analysts to replicate the results of an analysis are required if the public and policymakers are to have confidence in the information and claims

entered into public debate by parties on all sides of the Northern Pass debate.

Other key findings of the study include:

- Employment impacts of the project are highly dependent on whether in-state or out-of state firms are available and hired for the construction project.

- Studies and analyses of HVDC transmission lines indicate that by far the largest single cost item of the project will be the convertor station located in Franklin, NH, and the percentage of expenditures on the convertor station that benefit NH businesses will be among the lowest of any aspect of the project.

- Contracts for past transmission projects completed by Northern Pass's partners and their existing supplier relationships also suggest the dominant role out-of-state business and labor will play in the construction of the proposed project.

- Based on one measure of benefits, jobs per mile of transmission line, counties in Northern New Hampshire will receive disproportionately fewer benefits from the project

- Spending by out-of-state workers will range from a total of about $29 million to $31 million over the entire construction period, ranging from a low of $4.8 million in year one to a high of $10.8 million in year two of the project. This spending will support between 70 and 155 jobs in NH annually and could increase meals and rooms revenues by as much as $700,000 in year two of the project.

I. Introduction

Northern Pass Transmission, LLC has proposed building a 1,200 megawatt, direct current transmission line to bring hydropower from Canada for use by the New England regional power grid. The project is highly controversial, with debates over property rights, the potential use of eminent domain in completing the project, the effects on state and regional energy markets, as well as impacts on the environment, character and economy of New Hampshire's North Country all being argued by opponents and proponents of the project. These are often heated debates but effective public policy making requires a reasoned and tempered assessment of the relative costs and benefits of the proposed project. Benefits and costs will play an important role in the decision making process involving the Northern Pass transmission line (NPT). Costs and benefits related to the project can take many forms but to date the focus has been on the impacts that construction of the proposed project could have on jobs in the state of New Hampshire, with Northern Pass LLC being the only organization offering an estimate of job impacts to this point. Studies on job impacts produced by Northern Pass LLC, however, provide little detail with which policymakers can evaluate their findings, claims and conclusions regarding job impacts.

Prudent policy making requires validation of information entered into policy debates and the examination of information from multiple sources and from different perspectives. This study uses prior studies of the construction costs and economic impacts of high-voltage transmission lines and structures, including high-voltage, direct current (HVDC) transmission lines along with capital cost models used by energy planning organizations to estimate the type and level of expenditures that result from the proposed Northern Pass transmission project. The availability of qualified businesses and workers in New Hampshire capable of meeting the demand for goods, services, and workers associated with the proposed construction project is examined. The study estimates the volume of project expenditures that will go to New Hampshire businesses and workers and uses an economic model of the State of New Hampshire to determine the jobs impacts in the state that will result from expenditures in the state. Job impacts are estimated at both a statewide and county level are used to develop a cost/benefit measure - job impacts per transmission mile - to assess the relative costs and benefits of the construction phase of the proposed project to. Spending by out-of-state construction workers expected to work on the

project is estimated and the impact of that spending on jobs in New Hampshire is calculated. Finally job impacts of the proposed project are placed into context by demonstrating their impact on forecasts of employment growth in New Hampshire.

II. Statewide Job Impacts

Construction employment estimates in this report are derived using the standard methodology of input-output modeling. In estimating the employment impacts of the project, the dollar value of the project's construction expenditures occurring in the region is divided by the average productivity (the value of what each worker produces in one year) of workers employed in the construction industries affected (electric power transmission line and electric utility structures) in the region to arrive at an estimate of the number of workers needed to complete the project. Total construction jobs are then allocated according to the construction schedule and timing of expected expenditures to arrive at annual construction employment estimates. Spending by out-of-state construction workers was also estimated and added separately to total job estimates.

The number of on-site construction workers will vary during the construction phase. Employment estimates produced by NPT provide some indication of the timing of construction expenditures. Based on our baseline allocation of project expenditures that will go to NH-based businesses and workers (detailed in Section VII of this report), a total of 1,515 jobs over four

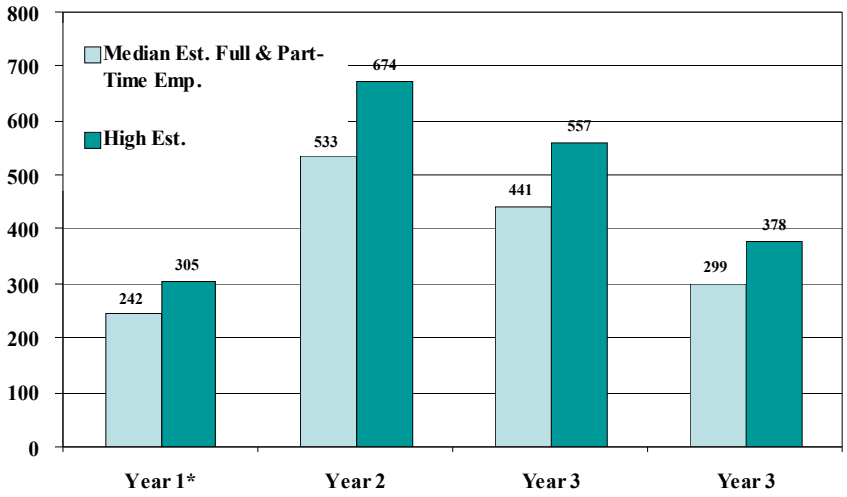
Table 1
NH Employment Impacts From Northern Pass Construction

		Yr 1**	Yr 2	Yr 3	Yr 4	Totals
Statewide	**Direct**	132	292	242	164	829
	Indirect	45	100	83	56	285
	Induced	64	141	117	79	401
	Total	241	533	441	299	1,515
On-Site NH Construction Workers		99	219	181	123	621
On-Site Out-of State Construction Workers		255	565	467	317	1,604

** Year 1 includes all activities and expenditures prior to the beginning of construction as well as the first year construction activity.

years will be supported in NH in response to project related spending in the state. Annual employment impacts range from a high of 533 in the second year of construction activity, to a low of 241 for the first year of construction - including all activity up to the beginning of construction (Table 1).

Figure 1
NH Job Impacts from Construction Spending are Estimated to Peak at Below 700

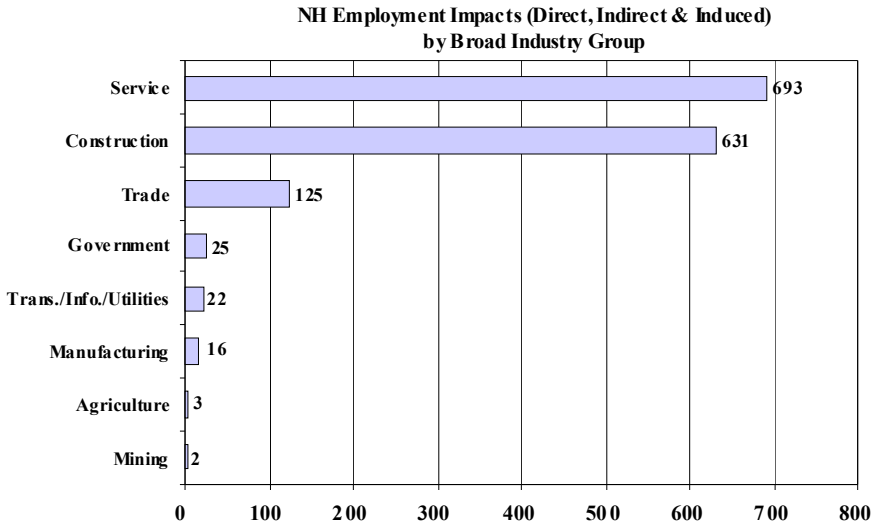


Of the total estimated job impacts, about 620 are expected to be direct, on-site construction jobs, with another 11 construction jobs created as a result of multiplier effects. This represents about 30 percent of the direct construction jobs expected to result from the project. Figure 1 shows the estimated job impacts each year under our baseline (most likely) and high estimate scenarios. Because of the specialized nature of transmission line, convertor and substation construction, a larger percentage of construction jobs obtained by NH workers will likely be as construction laborers and other less specialized occupations associated with heavy construction and general contracting rather than specialized occupations which will more likely be imported by out-of-state construction firms hired for the project. Figure 2 presents a breakdown of employment effects by broad industry groupings.

The productivity, practices, and staffing patterns of individual companies differ; the employment estimates presented here are based on industry averages in the region and are not

Figure 2

Construction Jobs Will Account for About 40 Percent of Employment Impacts in New Hampshire



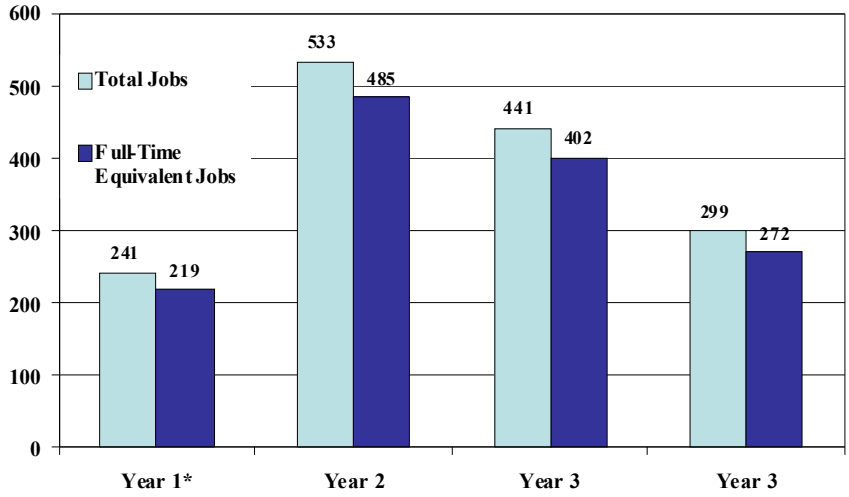
specific to any individual company. Thus, they are likely to differ from the estimates of any individual construction company and may vary somewhat by estimates produced by individual contractors. The authors believe, however, that the estimates presented here represent an empirically sound estimate of the NH employment impacts of the construction phase of the project.

Full Versus Part-Time Employment Impacts

Estimated jobs impacts include both full and part-time jobs, both in this study and in the estimates produced by NPT. The IMPLAN model used in this study, as well as the REMI, and RIMSII models used in the NPT studies, report job impacts that include both full and part-time employment. Converting jobs in an industry to a full-time equivalent (FTE) basis differs for each industry and depends on the percentage of full and part-time employees in each industry. This report converts employment impact results to FTE employment using conversion rates for each industry from the U.S. Bureau of Economic Analysis's "National Income and Product Accounts" series. Figure 3 presents both total estimated job impacts from the proposed NPT as well as job impacts converted to FTE. Jobs in most construction and service industries have a relatively high percentage of full-time versus part-time employment, while industries such as food services and accommodations tend to have higher rates of part-time employment. Converting to FTE jobs

reduces estimated the employment impacts of the proposed project by about nine percent, from 1,515 to 1,379 jobs over the entire construction period (Figure 3). The impacts of full versus part-time employment become greater when we consider the job impacts related to spending in NH by out-of-state construction workers.

Figure 3
Converting Jobs Impacts to Full-Time Equivalent Jobs Reduces NH Job Impacts by About 9%, to 1,379



* Year 1 estimates include impacts in years prior to the start of construction activity

Comparing Job Estimates from Different Studies

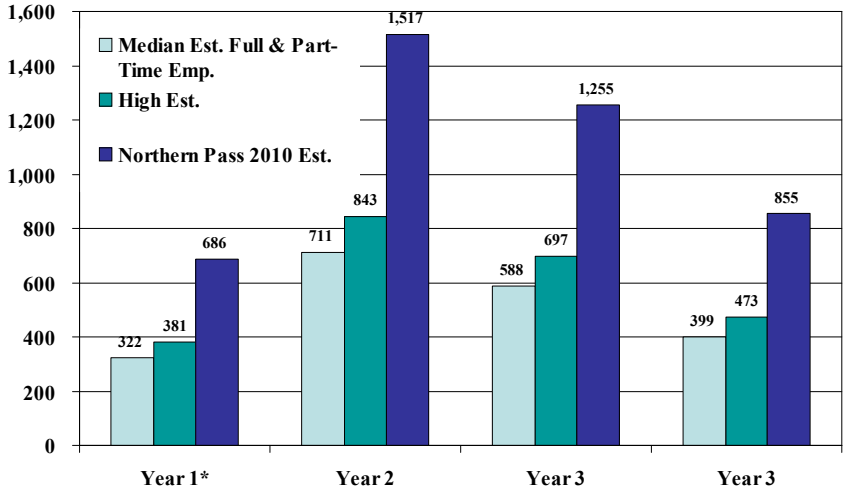
Compared to estimates by Northern Pass Transmission, the job impacts estimated here are much more conservative. In part, this reflects differences in the aggregate level of project expenditures expected to benefit NH businesses and workers. It may also reflect difference in the distribution of project expenditures among different industries and the use of different models or modeling procedures.[1] Without more detail on how the NPT estimates were prepared it is not possible to point to a specific reason for differences in estimated job impacts, other than the aggregate amount of expenditures allocated to NH, nor is it possible to evaluate NPT's estimates or the procedures used in developing them. Our methodology for allocating project expenditures to NH and among industries is documented throughout this report. The most widely used input/output model available for estimating the job impacts of transmission projects is used and

we believe an accurate estimate of the NH job impacts of the proposed NPT project is presented.[2]

Our baseline and high estimate of project job impacts is presented in Figure 4 along with those produced by NPT. The chart shows that compared to NPT estimates, the job impacts of the Northern Pass Transmission project are only one-half as large as the number of jobs estimated by NPT studies, even when jobs not estimated in the NPT studies (those associated with expenditures by out-of-state construction workers) are included in the estimates.

Figure 4

Even Including Spending by Out-of-State Workers (Not Estimated in Northern Pass Study), NH Job Impacts are Much Lower Than Estimated in Other Studies



III. Job Impacts by County

Construction activity along the proposed NPT route will produce different levels of economic activity throughout the state. The largest volume of construction activity will occur in counties with the most miles of transmission line construction, and where the convertor and substation construction take place. To model impacts at the county level we used IMPLAN's 2010 county level input-output models for each NH county. We allocated project expenditures according to the dollar value of construction that will occur in each county based on the estimated miles of transmission line and increase in property valuations in each town and county produced for NPT.[3] This procedure produces only a rough approximation of job impacts by county because the construction activities that benefit NH workers may be performed in one county by NH

workers living in a different county. For this reason, estimates should be viewed as the potential jobs that could be available in each county. For example, because Coos County has a smaller labor force and contains fewer of the workers with skills that will be required by the project, it is likely that many, if not most, of the direct jobs that are identified as occurring in Coos County will actually be held by residents from other counties. Table 2 presents estimated jobs that could be supported by project expenditures in each county (even if jobs are held go to residents of other counties). The table indicates that the indirect and induced job impacts (the multiplier impacts) for each direct job in Coos, Grafton and Belknap Counties are much smaller than are the multiplier impacts in the remainder of the state. These counties have fewer of the "upstream" industries that supply the construction and other industries that receive direct project expenditures.

Table 2
Potential Job Impacts by County

Employment (Full & Part-Time)	Belknap	Coos	Grafton	Merr.	Rock.	Remainder Of NH	State Total
Direct	28	234	217	306	44	0	829
Indirect	10	53	56	99	16	50	285
Induced	10	64	56	145	25	101	401
Total	48	351	329	550	85	151	1,515

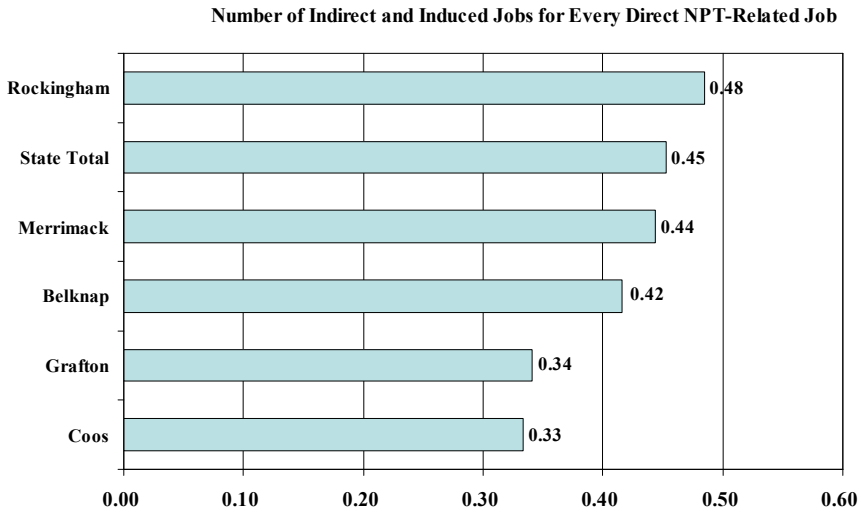
An explanation of direct, indirect and induced impacts is presented in Appendix A.

In contrast, parts of the state where no direct construction activity occurs disproportionately benefit from indirect project expenditures, as counties such as Hillsborough have the industrial structure and more of the businesses that supply goods and services to construction and other industries receiving direct project expenditures, while Coos and Grafton have fewer of them. In addition, other parts of the state receive a disproportionate share of induced employment effects compared to Coos, Grafton, and Belknap Counties as a larger percentage of income earned as a result of project related employment is spent outside of those counties.

Figure 5 shows the number of indirect and induced jobs in each county for every direct NPT-related job in the county, a measure of each county's ability to capture the multiplier impacts of construction activity.

Figure 5

Multiplier Impacts are Smallest in Northern Counties, Including Counties With the Most Miles of Transmission Lines



Jobs Per Mile of Transmission Line as a Measure of Relative Job Benefits

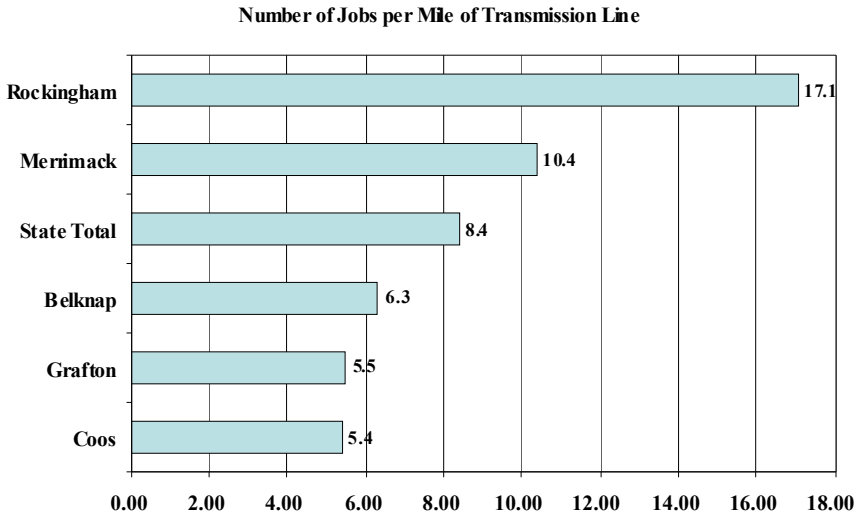
Evaluating the proposed NPT project involves weighing both benefits and costs of the project. Longer-term costs and benefits in terms of property values and taxes, recreational and tourism, and energy prices are the subject for another report. This report considers the more limited set of benefits and costs during construction of the project.

County job impacts estimated in this report can be used to evaluate the short-term cost/ benefit ratio for each county related to the proposed NPT construction project. Assuming that residents bear a cost, aesthetic, and other, for each HVDC transmission tower located in their county, and that the number of potential project related jobs in each county is a benefit, then the jobs per mile of transmission line in each county can be a useful metric of relative, short-term (during construction) economic benefits in comparison to the costs associated with having HVDC transmission lines running through their county. The measure does not, however, factor in differences in relative costs of lines and towers among counties. That is, it is possible that the cost of transmission lines is much higher in rural areas that rely on the natural environment to attract and retain residents and promote economic activity. In that case, the benefits of tower construction would have to be much higher in those counties to help compensate them for the higher cost to them of the towers. As Figure 6 demonstrates, however, NH's Northern, rural

counties receive a lower level of economic benefit (jobs) per mile of transmission lines than do more Southern NH counties. In large part this is a result of the convertor and substation construction in Merrimack and Rockingham Counties which results in job impacts beyond those associated with tower and transmission line construction. Counties where convertor and substations construction occurs (Merrimack and Rockingham) will have a higher number of jobs per transmission mile because more spending will occur in those counties relative to each transmission tower built. At the same time these counties will bear fewer of the costs that may be associated with high-voltage towers. Fewer job impacts in NH's Northern counties is also a function of the fact that these counties have economies that are less able to capture the economic activity associated with transmission line and tower construction.

Figure 6

Jobs Per Mile of Transmission Line is One Measure of Relative Benefits and Costs to Counties



As importantly, to the extent that the jobs resulting from direct project spending in a county go to workers living in other counties, NH's northern counties will receive even fewer job benefits per mile of transmission line. This is likely to be a significant occurrence. At best these ratios represent only *potential job benefits* per mile of transmission line located in a county, with an expectation that for Northern counties much of that job potential will be realized by other

counties in NH when NH workers from outside the North Country obtain project related jobs potentially available to workers from the North County.

IV. Impacts from Spending by Out-of-State Workers

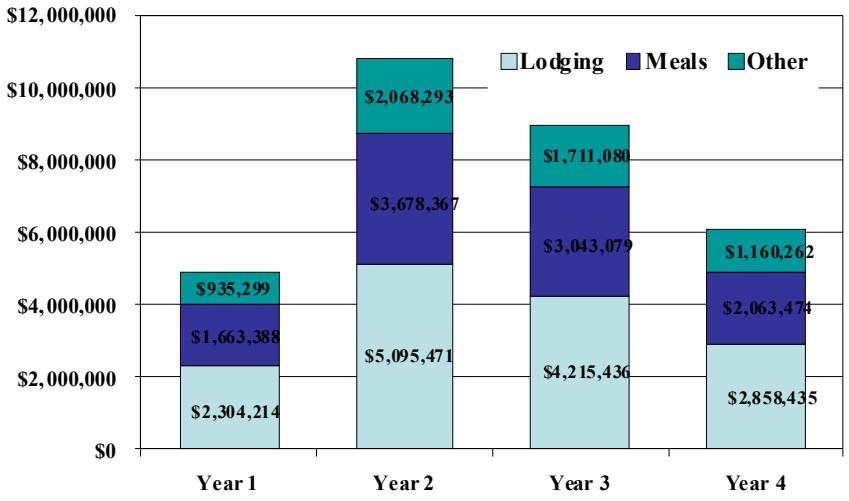
When out-of-state construction firms are used on the proposed NPT project, this research assumes that a majority of the workers used by the firm are out-of-state workers whose primary spending occurs outside of New Hampshire. However, out-of-state workers will have living expenses while in NH during the construction period. This research summarizes the per day spending of this transitory workforce as approximately $80 per day per worker, less assumed vacation and other days not spent in state. This translates into an average annual expenditure by out-of-state construction workers of about $19,200 per year.

In our model, the number of out-of-state construction workers depends on the allocation of project expenditures between NH and out-of-state firms. If more project expenditures occur in NH than expected in our baseline (or most likely) scenario, then fewer out-of-state workers will be used and the amount of aggregate spending by out-of-state workers will be lower. This process allows for a more dynamic estimate of the overall impact of in-state versus out-of-state employment has on overall impact estimates.

The average daily spending of out-of-state construction workers was derived from the 2010 Survey of Visitors to New Hampshire, conducted by the Institute for NH Studies at Plymouth State University, for the Office of Travel and Tourism of the State of New Hampshire. The average daily spending of overnight visitors from outside of the New England Region was found to be about $69 per day in the spring of 2010, divided into three broad categories, lodging, food, and "other". The $69 per day expenditure amount was adjusted upward in our analysis to $80 to account for price inflation between 2010 and the projected construction period. Like most overnight visitors to NH, as indicated by visitor surveys, it is expected that many out-of-state workers will share the cost of lodging among more than one worker.

This research estimates that the spending by out-of-state workers under our baseline scenario will be approximately $31 million over four years, peaking at about $10.8 million in the second year of construction. If a smaller number of out-of-state construction workers are used on the construction project, as in our higher NH employment estimate, then fewer out-of-state workers will be in NH and their spending will be lower by approximately $2.5 million over the three year construction period (Figure 7).

Figure 7
Spending by Out-of-State Construction Workers Will Peak at About $10.8 Million and about $31 Million Total

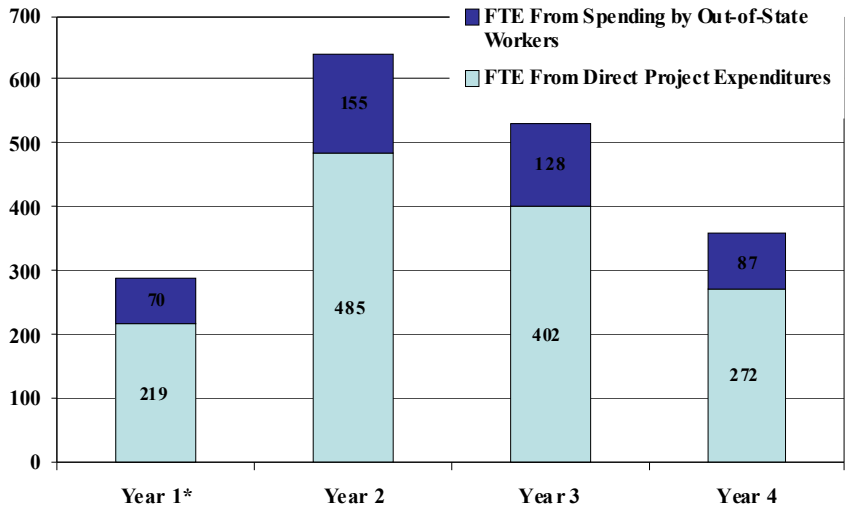


If all lodging and meals spending by these workers occurred at hotels, motels, and restaurants where expenditures are subject to meals and rooms taxes (an unlikely scenario because it assumes workers would never prepare their own meals or rent apartments where meals and rooms taxes are not collected), this would increase spending in those categories by about $8.8 million in the peak year of construction, increasing annual meals and rooms revenue by about $790,000 or .003 (three tenths of one percent).[4] However, the impact that the proposed NPT project may have on recreational and tourism activities in NH during and after construction may have corresponding negative impacts on meals, rooms, and other state revenues.

Estimated spending by out-of-state workers was input into the IMPLAN model of the NH economy to determine the overall impact of these expenditures on jobs in the state. On a full-time equivalent basis, spending by these workers in New Hampshire will support between 70 and 155 jobs in New Hampshire during project construction (Figure 8).

Figure 8

Spending by Out-of-State Workers Will Support Between 70 and 155 Full-Time Equivalent (FTE) Jobs

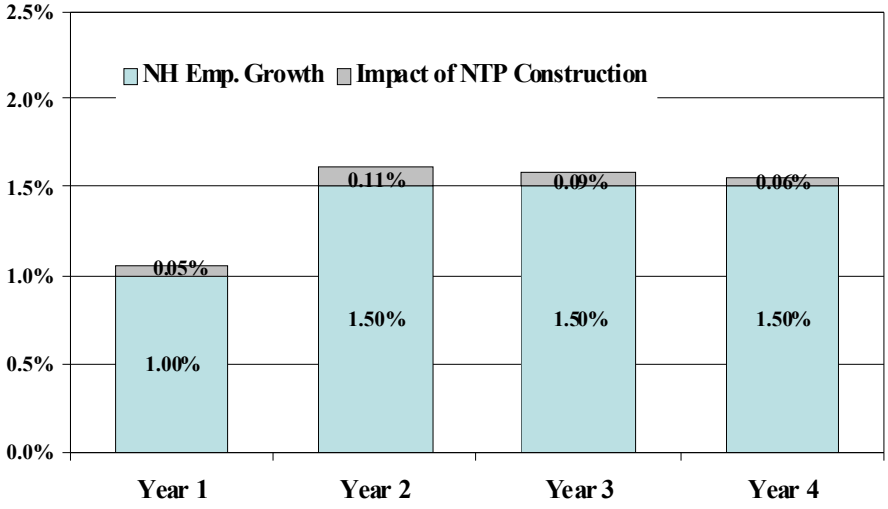


V. Impact on New Hampshire's Employment Growth Forecast

Combining the job impacts of NPT construction spending with the job impacts related to spending in NH by out-of-state construction workers provides an estimate of the overall impact the NPT will have on employment in the state. Combined, these two impacts are estimated to increase the forecasted rate of job growth in NH[5] by a high of about one-tenth of one percent (.001) in the second year of construction (Figure 9).

Figure 9

The Emp. Impact of NTP Construction Increases NH's Employment Growth Forecast by as Much as One-Tenth of One Percent



Source: New England Economic Partnership forecast of the NH employment, November 2011 (used for years 2-4 of construction), PolEcon forecast (used for year 1 of construction).

VI. Availability of Project Inputs in New Hampshire

The size of the job impacts from transmission projects is highly dependent on whether New Hampshire businesses and workers are chosen to be primary contractors, engineers, and suppliers. To determine the potential for the proposed project to use in-state businesses we:

- Examined data on the number of businesses and current employment levels in NH for key industries that provide inputs to the electric power lines and structures construction industry.

- Queried NH businesses in key project related industries regarding their capabilities to supply inputs to the project.

- Examined the database of national trade organizations (including the National Electrical Contractors Association and the American Institute of Steel Construction) in the electrical and power lines and systems contracting and steel fabrication industries to find NH-based businesses that have the capabilities to supply key project inputs.

- Reviewed labor market data in NH on the current availability of occupational employment for key jobs in transmission line construction and in electric power facilities construction.

- Examined information and reports on completed transmission line projects

> across the country, including a recent transmission line project in Connecticut completed for Northeast Utilities, to determine the patterns of use of in-state versus out of state contractors and suppliers.

Based on discussions with industry experts and a review of studies on regional economic impacts of transmission line construction, the selection of a local contractor is much more likely for smaller transmission lines. Higher-capacity transmission lines require highly-specialized workers and the ability to directly contract with manufacturers to supply inputs. Bigger projects (in terms of miles and expenditures) may also be too large for New Hampshire contractors that may not have the staff, resources, experience, or supplier relationships to handle large transmission projects. Additionally, some research suggests that economies of scale exist in transmission line construction, which results in only a few large firms having the capability of handling major projects.

The selection of a local contractor also increases the likelihood that in-state engineering firms, legal firms, and other suppliers are used on a project because profitable business relationships already exist between the in-state firms. In contrast, larger out-of-state firms likely have business relationships directly with the manufacturer of the needed inputs and have their own engineers and other staff in-house. Larger transmission projects utilize out-of-state suppliers and labor and therefore have a smaller impact per mile or per investment dollar (although possibly larger overall due to the size of the project), while smaller transmission projects may be completed by an in-state firm utilizing in-state suppliers and workers and therefore have a larger impact per mile or investment dollar.

However, even with the selection of an in-state contractor, there are still economic impacts that are lost because the money is spent on inputs sourced outside the state's borders. For example, there are not any New Hampshire companies that manufacture the type of wire needed for high-voltage transmission lines, nor are there any companies that fabricate tubular steel structures (towers) on which the HVDC lines will be strung. Calls to the largest structural steel fabricators in the state confirm this. Nor is any of the high-priced electrical equipment used in the conversion of HVDC to HVAC manufactured in New Hampshire. The manufacturing jobs associated with production of the key materials used in construction the transmission line will not

have a positive economic impact on NH because these jobs occur outside the state of NH. Using data from the U.S. Bureau of Labor Statistics' and from NH's Labor Market Information office, as well as the U.S. Census Bureau's "County Business Patterns" reveals that most transmission line, convertor and substation inputs are not available in New Hampshire, or their availability is insufficient to meet the demands of a project the size of the proposed NPT project. Table 3 presents key industries involved in transmission line construction along with their associated North American Classification System (NAICS) code, and the degree to which the industries are present in NH.

Table 3
Industries Involved in Transmission Line and System Construction

Business Activity	NAICS	NAICS Title	Is there a NH Company in this Industry?
Transmission of electric power	221121	Electric Power Transmission and Control	Yes
Transmission and distribution line, convertor and substation construction	237130	Power and Communication Line and Related Structures Construction	Yes, about 600 employees, about 1/3 in power related construction. None that specialize in convertor or substation construction.
Transmission tower sections, fabricated structural metal, manufacturing	332312	Fabricated Structural Metal Manufacturing	Yes, but none that specialize in tubular steel of towers
Transmission and distribution voltage regulators manufacturing	335311	Power, Distribution, and Specialty Transformer Manufacturing	Yes, but less than 50 employees total. None that produce for transmission systems
Transmission wire manufacturing	33592	Communication and Electrical Wire and Cable Manufacturing	Yes but none that produce high voltage transmission wire
Transmission pole and line hardware manufacturing	335931	Current-Carrying Wiring Device Manufacturing	Yes but unknown if they produce for transmission systems
Transmission equipment, electrical, merchant wholesalers	423610	Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers	Yes but local wholesalers not typically used by out-of-state construction management firms

Source: U.S. Department of Labor, U.S. Census Bureau "County Business Patterns, 2009", PolEcon Bureau.

Industry sources involved in transmission line projects also indicate that wholesalers are not typically used when purchasing these products from out-of-state manufacturers, so the only impacts to New Hampshire businesses from these purchases would be the transportation of the goods to the worksite. These transportation costs are minimal as the contractor typically fulfills this job duty internally. There are also inputs like equipment rental that are available in New Hampshire, but not in the quantity or specific product needed for the transmission line product. Contractors must obtain the right quantity and type of product from an out-of-state business.

PolEcon queried the nationwide database of contractors of the National Electrical Contractors Association for NH contractors capable of completing a small transmission line or substation construction project of just $50 million. Results showed many firms in New England but none in NH. Table 4 shows the distribution of firms in NH in the power and communication lines and related structures construction industry. A total of 640 workers were employed in NH in the industry in 2009, 30 to 40 percent in electric power lines and structures construction and the remainder in telecommunications construction.

Table 4
Power and Communication Line and Related Structures Construction Employment in NH by County

County	Emp 2009	Total Establishments	Size of Establishment (Emp.)					
			1-4	5-9	10-19	20-49	50-99	100+
Belknap	71	3	0	1	1	1	0	0
Carroll	B	3	2	0	0	0	1	0
Cheshire	B	2	0	1	0	1	0	0
Coos	A	2	0	1	1	0	0	0
Grafton	B	1	0	0	0	0	1	0
Hillsborough	B	5	2	0	2	0	1	0
Merrimack	89	8	3	2	1	2	0	0
Rockingham	104	7	5	0	0	1	1	0
Strafford	B	2	1	0	0	0	1	0
Sullivan	A	1	1	0	0	0	0	0
Totals	**640 Total**	**34**	**14**	**5**	**5**	**5**	**5**	**0**

A = 0-19 employees
B = 20-99 employees

Source: U.S. Census Bureau, *County Business Patterns in NH, 2009*.

Examining the occupational composition of the power and communication line and related structures construction industry (NAICS 237130) using data from the U.S. Bureau of Labor Statistics "industry-occupation matrix" suggests that about 21 percent of the employment in this industry is likely to be electrical power line installers or repairers.[6] Another 26 percent of employment in the industry is in construction trade occupations that are not broken down by power and telecommunications related construction. Combined, this implies that there are about 200 electrical power line installers and construction workers employed in the construction industry in New Hampshire. Power line installers also are employed by the electric power industry itself. In total, the NH Department of Employment Security estimated that there were about 380 electrical power line and structure installers in NH as of May of 2010, again, many employed by electric utilities in the state (Table 5). According to the U.S. Bureau of Labor Statistics, about 50 percent of electrical power line installers are employed in the electric power industry,[7] again, suggesting that there are likely about 200 electric power line installers in NH's workforce, outside of the electric utility industry. No additional employment or visitor related spending benefits will accrue to the state's economy for every employee of a NH electric utility that works on the project.

Table 5
Electrical Power Line Installers in NH's Workforce

Statewide Occupational Employment & Wages	SOC Code	May 2010 Estimated NH Employment	Entry Level Wage	Mean Wage	Median Mean
Electrical Power-Line Installers and Repairers	49-9051	380	$26.71	$32.88	$33.86
Telecommunications Line Installers and Repairers	49-9052	790	$15.10	$25.81	$27.06

Source: NH Department of Employment Security

Transmission line construction will also require some temporary construction hires that have less specific construction skills, but will need to operate heavy machinery and complete general construction projects. The NPT project will likely find an ample supply of available general construction labor due to the large numbers of construction workers who have lost their

jobs during the recent recession. These occupations are a smaller percentage of the required workforce for the transmission project but they are more readily available in NH and will comprise the majority of construction jobs available to NH residents.

A query of the American Institute of Steel Construction (AISC) yielded 11 AISC certified NH firms that fabricate structural steel (Table 6). The two largest fabricators have approximately 100 employees each and neither produces the steel (typically tubular steel) used for transmission towers. A review of these company websites, including project capabilities and histories, and calls to company officials indicates that they do not produce or erect structural steel for the electric power transmission industry. A search of the AISC database for certified steel erectors in the state did not produce any results. While there are firms in NH that perform such work, the fact that they are not listed in the AISC database suggests they would not likely have the size or capability to erect the more than 1,000 towers needed to complete the transmission line.[8]

Table 6
Certified Structural Steel Fabricators in NH

Company	City	State	State of Business
American Steel Fabricators, Inc.	Greenfield	NH	CT , ME , MA , NH , NY , VT
Atlantic Bridge & Engineering	Candia	NH	CT , MA , NH , NY
Blouin Steel Fabricators, Inc.	Northfield	NH	ME , MA , NH , VT
Broadway Steel, LLC.	Laconia	NH	ME , MA , NH , VT
Isaacson Structural Steel, Inc.	Berlin	NH	CT , ME , MA , NH , NY
Methuen Construction Company, Inc. dba Summit Metal Fabricators	Salem	NH	CT , ME , MA , NH , NJ , RI , VT
Novel Iron Works, Inc.	Greenland	NH	CT , ME , MA , NH , NY RI , VT
Rescue Bridge Repair	Somersworth	NH	CT , ME , MA , NH , NY , VT
Rose Steel Inc.	Greenland	NH	CT , ME , MA , NH , RI , VT
S.L. Chasse Welding & Fabricating, Inc.	Hudson	NH	MA , NH
Structural Bridges, A Division of Canam Steel Corporation	Claremont	NH	CT , ME , MA , NH , NJ , NY , PA , RI , VT , VA , WV

Source: American Institute of Steel Construction contractor database

Use of Local Contractors by Northeast Utilities and NPT

Northern Pass Transmission has indicated it will use local contractors and suppliers when possible but has made no commitments and has provided no data (other than estimates of the

aggregated amounts) of the percentage of local inputs that will go into the project. However, past transmission line construction projects by Northeast Utilities provide some indication of the pattern of local contracting and the likelihood of local contractors being used. Northeast Utilities has used M.J. Electric, headquartered in Iron Mountain, Michigan for most of its recent construction projects, including Bethel to Norwalk transmission project in Connecticut, the construction of the Killingly substation in Connecticut, instrumentation for the scrubber at Merrimack Station in Bow, NH, as well as for hurricane Irene related transmission line and substation repairs throughout the region. M.J. Electric is a major electrical contractor that completes transmission line and substation construction projects throughout the country. The website of M.J. Electric lists Northeast Utilities as one of its customer "alliances".

For the overhead transmission line portion of Northeast Utilities' $1 billion, 70 mile Middletown to Norwalk transmission line project, PAR Electrical Contractors Inc., headquartered in Kansas City Missouri was the prime contractor.[9] PAR also has offices in East Windsor, CT., making them a prime candidate for work on the proposed NPT project. The use of PAR or any other out-of-state contractor does not preclude use of some local labor and PAR itself notes that it is a union contractor that contracts it crews from the International Brotherhood of Electrical Workers (IBEW). According to PAR:

> *"PAR's field employees are members of the International Brotherhood of Electrical Workers (IBEW). In addition, six of PAR's officers hold positions in the National Electrical Contractors Association (NECA). This strong IBEW/NECA connection provides our clients with uniquely trained, highly productive and safety-oriented personnel. In this time of acute labor shortages, the availability of qualified line crews is critical. PAR can meet all your labor needs—a claim many contractors make but can't deliver like PAR".*

The procurement relationships any out-of-state contractor reduce the likelihood of the use of in-state inputs in the project even if they are available.

For the Middletown to Norwalk transmission project, Burns & McDonnell, Inc. was the project management, engineering and design firm used. With offices worldwide, Burns and McDonnell also has an office in Wallingford, CT. This does not mean that this particular firm would be used for the proposed NPT project, but by examining the capabilities and expertise of

this firm suggests that there is no equivalent company in NH with similar capabilities.

High-Voltage Direct Current Projects Require More Specialization

The use of HVDC for the proposed NPT project requires convertor stations (one proposed for Franklin, NH) to convert direct current imported from Canada to the alternating current used on our nations electric grid. According to a 2003 study by a leading electric power consulting firm (Black & Veatch, 2003) conducted to evaluate the potential use of HVDC technology for Northeast Utilities' Middletown to Norwalk transmission line project, convertor stations are by far the most costly portion of HVDC systems (typically accounting for about one-half of all project costs when convertor stations at both ends of the transmission line are used – for the NPT project only one convertor station is included in the U.S. cost estimates, although a convertor in Canada would also be required). [10] The specialized capabilities and high cost of these HVDC convertor station construction projects has resulted in just a few firms worldwide with the capability to design and construct them. Currently three companies nationally and worldwide (Siemens, ABB, and Alstrom) appear to construct most, if not all, HVDC convertor stations. The Black & Veatch study also notes that these three companies typically design, procure for, and construct the convertor stations on a "turnkey" basis (they are responsible for all aspects of the project), making it even less likely that NH firms will participate in their construction.

Using the Western Electricity Coordinating Council's TEPCC model[11] to approximate the cost structure the proposed NPT project costs also concludes that the HVDC convertor stations are the largest cost elements of an HVDC project. Project cost estimates provided by NPT include only the cost of the convertor station at the U.S. end of the transmission line but this is still likely the single largest expense in the project. The expense of convertor stations is one reason why more HVDC transmission lines are not used. Some estimates suggest that unless transmission lines are at least 300 miles in length then the high cost of HVDC convertors cannot be justified.

Estimates of property tax valuations provided by NPT to estimate local property tax payments by town in NH also provide an indication of the cost of the convertor station in Franklin and substation modification in Deerfield. The vast majority of expenditures (which include expensive electrical equipment manufactured throughout the world and very specialized labor and contractors) on these high-cost project elements will be to out-of-state firms and workers. Several

studies of the impacts of transmission projects on state economies, including those done for the electric power construction industry, allocate none of the expenditures related to constructing these structures to businesses in the states in which they are located. Nevertheless, our modeling of project expenditures allocates between 7 and 10 percent of the cost of these convertor stations to New Hampshire businesses and thus may overstate somewhat the percentage of local construction labor used in completing the projects.

This research assumes that in-state firms will use primarily in-state workers, which results in a larger impact because these workers dispose of their earnings primarily within the state. Out-of-state firms will likely bring their existing workforce into the state, so the economic impact from these out-of-state workers is limited to spending on lodging, food, retail, entertainment, and other spending similar to visitors to the state.

VII. Estimating Northern Pass's Project Expenditures in New Hampshire

The size of the economic impact from transmission projects is highly dependent on whether New Hampshire businesses and workers are chosen to be primary contractors, engineers, and suppliers, and how much of total project expenditures go to NH businesses. To estimate the percentage of project expenditures going to NH firms it is necessary have a more detailed understanding of the pattern of project expenditures across different types of industries than is provided in any publicly available material from the NPT.

The analysis in this report adopts a 'production function' approach to estimating the job impacts of the proposed NPT project on New Hampshire. In order to develop input-output impacts and multipliers for the NPT project, total project investments (as reported by NPT) were divided among industries that experience an increase in demand when electric power transmission lines and structures are built. Several sources were used to allocate total project expenditures in a production function and to adjust the percentages allocated among industries to reflect the unique aspects of the proposed NPT project (such things as an HVDC project with only one convertor station rather than two included in project costs and modification and expansion rather than construction of one substation). After a production function was developed, the percentage of expenditures that will benefit the New Hampshire economy was estimated. Sources used in developing a production function and allocating expenditures to

NH included:

- Black & Veatch's (2003) HVDC feasibility study for Northeast Utilities.
- A 2009 study by NorthStar Economics Inc. for the American Transmission Company on the impacts of transmission line construction in the Midwest. This study did not include expenditures unique to HVDC projects but provided detailed breakdown of the transmission line only (not convertor or substation expenditures). [12]
- A 2011 report by the National Renewable Energy Laboratory of the U.S. Department of Energy on the impacts and costs of transmission line construction in Wyoming. This study provides comparison costs for HVDC versus HVAC transmission systems. In addition, it provides details on the material versus labor costs associated with HVDC transmission line and convertor station construction.[13]
- The Western Electricity Coordinating Council's "Transmission Expansion Capital Cost Planning Model". This was used to help estimate per mile transmission line construction costs in relation to other project costs including the cost of convertor and substation construction.
- A report by the State of Montana's Department of Labor on the impacts of transmission line construction in that state.
- A number of other studies and industry documents and models were reviewed.

The final allocation of project expenditures was based on all of these sources but reflects unique aspects of the proposed NPT project. A production function for construction of the transmission line portion of the project was developed first. A separate estimate of the cost of convertor and substation components and construction was developed and separated into materials and labor components. Table 7 presents estimated allocation of transmission line spending using the studies and industry sources listed above.

Table 7 is a linear production function; however, there is reason to believe that the actual production function for transmission lines is non-linear in some of the physical inputs, resulting in estimate error that increases as the size of the transmission line increases. Large transmission line projects may spend a smaller percentage of their capital expenditure on

engineering or consulting services, and a greater percentage of their expenditure on physical inputs like steel structures, concrete, and wire. The allocations in Table 7 are developed from information derived from transmission line projects across the country, some of them much smaller than the proposed NPT. Thus some of the allocation above has been adjusted for the size of the NPT.

Table 7
Pct. Of Transmission Line Construction Inputs by Industry and Percent of Inputs Purchased in NH by Use of In-State Versus Out-of-State Contractor

			Percent Spent in NH	
IMPLAN 3 Sector	**Industry/Commodity**	**Percent of Total Spending**	**In-State Contractor Used**	**Out-of-State Contractor**
3162	Preformed Concrete	0.12%	0%	0%
3186	Steel Structures	3.82%	0%	0%
3266	Electrical materials	35.58%	0%	0%
3272	Cables and materials	25.00%	0%	0%
3360	Real Estate	0.60%	100%	100%
3387	Fencing and Security	0.13%	100%	100%
36	Construction Services*	20.57%	60%	40%
330	Miscellaneous Materials	0.01%	100%	100%
365	Equipment rental	6.13%	75%	25%
369	Engineering and consultants	6.00%	10%	10%
374	Management Consultants	0.25%	66%	10%
375	Mapping and Environmental Consultants	0.06%	66%	10%
376	Research	0.09%	66%	10%
377	Advertising and Printing	0.34%	100%	40%
378	Signage	0.03%	100%	100%
382	Temp Hires	0.61%	100%	100%
432	Fees	0.64%	100%	100%

* There appear to be no contractors in NH with the capacity to complete the project and the percentage of NH expenditures estimated to occur in NH with an out-of-state contractor is higher than estimated by some industry and other sources.

Estimates of job impacts from transmission project construction are highly sensitive to changes in the in-state purchase assumptions. The assumptions shown in Table 7 were developed after significant review of other literature and conversations with industry officials. In comparison to impact research conducted for the electric transmission construction industry, this production function results in a more conservative estimate of in-state spending. NorthStar Economics Inc., in a study for the American Transmission Company, estimated that approximately 45.8% of the costs to transmission line construction in Wisconsin remained in the state. A study in Montana conducted by economists at that state's Labor Department, however, estimated that only about 11 percent of expenditures remain in state if an out-of-state contractor was used. Studies for the NPT project estimate that 20-27 percent of expenditures remain in state. This study estimates that between 12 and 19 percent of expenditures, or from $120 to $204 million, benefit NH firms and workers, not including the impacts of the spending by out-of-state worker who temporarily locate in NH to work on the project. Adding the spending by temporary, out-of-state workers (which has a much smaller overall impact on the NH economy than dollars spent on project labor and materials in the state) increases the percentage of expenditures remaining in-state to between 13 and 21 percent.

VIII. Conclusions

The proposed Northern Pass transmission line has generated much public debate but relatively little empirical analysis with which to make to make a decision about the desirability of the project for New Hampshire and its residents. Analyses to date have largely been limited to those offered by proponents and participants in the project that provide relatively little data and information that allows for evaluating the validity of research findings. This report provides an independent analysis of the potential job impacts in New Hampshire resulting from the proposed project.

The proposed Northern Pass project will contribute to job growth in NH during a three year period, adding as much as one-tenth of one percent (.001) to forecast job growth during the second year of the construction project, but our results also suggest that estimates of job impacts produced by Northern Pass are much too high. Job impacts are highly dependent on the amount

of project expenditures that go to New Hampshire firms. Based on the availability in New Hampshire of needed project expertise, material and labor inputs, as well as evidence from past transmission line construction projects completed by Northern Pass partners, NH businesses are likely to benefit from no more than 11 to 19 percent of project expenditures.

Even when the job impacts related to spending by out-of-state construction workers are included (something not included in estimates of job impacts provided by NPT) our results indicate that the job impacts of the Northern Pass project will be about one-half the size estimated by NPT.

We also conclude that based on one benefit/cost measure, jobs per mile of transmission line, counties in Northern New Hampshire will receive disproportionately fewer benefits from the project.

Appendix A

Analytical Approach and Methodology

The Northern Pass Transmission Project LLC has provided little information about project expenditures other than an aggregate estimated of the total cost of the project ($1.1 billion) along with estimate of the aggregated (with no breakdown) amount of project expenditures it says will occur in New Hampshire ($200-$300 million depending on the report). Without more detail regarding project expenditures and assumptions it is difficult to evaluate their conclusions regarding employment and economic impacts, or to replicate their results.

To overcome the analytical difficulties posed by limited data on project expenditures, PolEcon employed a number of sources and techniques to estimate the breakdown of NPT project expenditures:

- We reviewed a high voltage direct current transmission line feasibility study done in 2003 for Northeast Utilities by electric power industry consultants Black & Veatch.[14] The study provided costs estimates and breakdowns of HVDC transmission lines and systems.

- We reviewed company press releases, required filings, industry websites and reports from completed transmission projects by Northeast Utilities and others to better understand the contracting process and expenditure patterns involved in electric power transmission and construction projects.

- We reviewed several studies of the economic impacts of transmission line construction, including those conducted by the transmission line construction industry and independent analyses conducted by state and federal government agencies. Some of these studies provided significant detail on transmission project costs, expenditures, and pattern of expenditures, including for HVDC construction projects.

- We used the Western Electricity Coordinating Council's "Transmission Expansion Capital Cost Planning Model" (TECCP Model) to better understand HVDC transmission costs, and costs in comparison to other transmission technologies.

- We relied on NPT estimates of their expected property tax payments by town in NH to allocated shares of project costs among counties.

This report does not attempt to develop overall costs estimates for the proposed project, rather it used the resources above to allocate project expenditures among industries for purposes of estimating economic impacts in New Hampshire. To evaluate the claims of NH job impacts made by NPT, this report uses a baseline total project cost similar to that used by NPT ($1.1 billion) although we allocate a different portion of project expenditures to NH firms and workers.

Input-output (I/O) methodology was used to determine the economic impacts of the project on the regional economy. The 2010 version of the IMPLAN model for the State of New Hampshire (the most recent model year available) was chosen because of its ability to construct a model using data for each New Hampshire county while maintaining rich detail on impacts for over 400 industries.[15] In addition to being widely used in regional economic analysis, the model and its methodology have been extensively reviewed in professional and economic journals. It is the most commonly used impact model used in estimating the impacts of large-scale construction projects in the electric utility industry.

I/O models trace the linkages of inter-industry purchases and output within a given county, region, state or country. I/O models use information on the commodities, goods and services that are required from all industries in order for any specific industry to produce each dollar of output. In addition, I/O models determine how much of the required inputs can be supplied locally, from within an economic region or study area. For the NPT, transmission line, convertor, and substation construction will require hundreds of millions of dollars of increased output by construction industries and the industries that supply goods and services to them. The analysis in this report uses the IMPLAN modeling system to determine how much of the NTP created increased demand for goods, services, and labor will be met by existing industries in the region and how much of the demand for goods and services will be met or "imported" by regions outside of the state of New Hampshire. This is a critical calculation for a project with both positive and negative economic and other impacts.

I/O models divide the impacts of a change in expenditures, industry output, or demand, into direct, indirect, and induced impacts. The latter two are so called 'multiplier effects." The three types of impacts are defined as follows:

- Direct effects are the set of expenditures applied to the predictive model (i.e., I/O multipliers) for impact analysis. It is a series (or single) of production

changes or expenditures made by producers/consumers as a result of an activity or policy. Applying these initial changes in demand to the multipliers in an IMPLAN model will then calculate how the region will respond, economically to these initial changes.

- Indirect effects are the impacts that result from the inter-industry transactions that occur in response to the direct effects. For example, for a large construction project, the direct construction expenditures will require construction companies to make purchases from other businesses, and for those businesses to make purchases of goods and services from other businesses in order to supply goods and services, and so on. Expenditures that go to businesses outside the region are considered "leakage" from the region and are not included in the indirect impacts.

- Induced effects are the response by an economy to an initial change (direct effects) that occur as a result of the income received by individuals and households from the direct and indirect project impacts. This money is re-circulated through the household spending patterns causing additional local economic activity.

State and County Level Impacts

This study uses both county and state level data in analyzing the economic impacts of the proposed Northern Pass Transmission project, reporting results for each county along the proposed transmission route as well as aggregate results that include impacts that occur in all other regions of the state. Counties where the majority of the transmission line is located are rural, without a large and diverse labor force that includes a large number of workers with skills and experience building transmission lines and construction electric power substations and convertors. Nor do counties and communities along the route of the transmission line include businesses that manufacture the poles, wire, or other inputs used in transmission line construction, or the sophisticated machinery and equipment that converts high voltage direct current (HVDC) to the high voltage alternating current (HVAC) used by our nation's electric grid. But the same can be said of the entire State of New Hampshire which lacks the manufacturers and special contractors that contribute most of the equipment and construction services to the electric power industry. This suggest that the majority of the labor and materials required to complete the project will come from outside the four-county Northern and Central counties (Coos, Grafton, Belknap, and Merrimack) area and the State of New Hampshire, and

relatively fewer workers in the state, and even fewer in the North County may benefit from the project.

For this study our primary interest is on the impacts to NH, therefore, if construction workers are from businesses in New Hampshire, even if the business is located outside of one of the counties along the route of the transmission line, they are counted in the employment numbers where their construction work occurs, even if workers are not residents of that county.

The employment impacts estimated in this report include workers in upstream businesses that supply inputs to industries that will construct the transmission line, convertor station, and expand the existing Public Service Company substation in Deerfield, NH, and they include the impacts that occur from the spending related to the income earned by workers as the result of the proposed project. Estimates of NPT's employment impacts at the county level will have a greater margin of error than will our estimate of statewide impacts. Project expenditures were modeled individually for each county and job impacts determined by the structure of each county's economy and the availability of the supplying industries. In many cases however, these supply or intermediate inputs will come from a single supplier located in one county who supplies goods or services to the entire project. This possibility is not factored into our modeling.

Why IMPLAN is a More Appropriate Model Than REMI to Estimate NPT Job Impacts

The use of IMPLAN to develop employment estimates of this type is fairly standard across industries, and has been especially used in assessing impacts of transmission lines and other energy projects. The National Renewable Energy Laboratory (NREL) of the U.S. Department of Energy uses the IMPLAN model extensively and the IMPLAN model provides the basic structure of NREL's "Jobs and Economic Development Impact Model" (JEDI) that it uses to evaluate the impacts of renewable energy projects.[16] IMPLAN is also used in studies conducted for the electric transmission line construction industry (NorthStar Economics 2009).

A review of the economic impact statements for several proposed transmission lines across the nation, including an October 2010 analysis conducted for NPT, revealed that IMPLAN or other input- output models are most commonly used to develop employment impacts. Regional Economic Models Inc.'s REMI "Policy Insight" model has also been used several prior studies

conducted for Northeast Utilities and NPT.[17] REMI is a dynamic model built on an input-output model structure. It is widely used and can provide helpful information for policymaking when assessing longer-term and broader implications of policies or economic activities. In the case of estimating the impacts of NPT construction, however, none of the features of REMI that produce dynamic or longer-term impact assessments was used (or the results of those analyses reported) so the information it provided differed little from those of an input-output model. In the case of NPT, REMI also suffers from other drawbacks compared to IMPLAN.

The REMI model used to assess employment impacts related to the proposed construction of NPT was a 23 industry sector model of the NH economy. This means that the model represents the workings and the interrelationships of the industrial structure of the NH economy using just 23 basic industries. There are many different types of construction industries that have very different labor and material input requirements, many of which have little or no presence within the State of New Hampshire. However, each of these different construction industries is treated similarly in the 23 industry sector REMI model, with construction activity, regardless of the nature of construction (residential, industrial, utility, infrastructure etc.) assumed to require similar inputs from and to have similar impacts on the NH economy. In the case of the NPT this is especially problematic because the construction activity associated with NPT (electric power lines and convertor stations and substations) is highly specialized and much less likely to be readily available in a state or region. Because REMI lumps this highly specialized construction activity in with all other construction activities, the model will produce results that can suggest a large volume of economic activity will be produced in a region from an industry that may not even exist (or has very little presence) in the region. When the REMI model lumps electrical power line and electrical power transmission line electrical generation structures construction in with all other construction activity, it assumes that inputs such as electrical power cables, transformers, tubular steel (for transmission towers), as well as the specialty construction contractors are as readily available in a region as are the wood, concrete, and framing carpenters needed to built residential buildings. The result can be a large estimate of economic impacts from an industry that may not exist in the region.

Every region has a construction industry that serves local residential, commercial and

industrial markets and that will produce significant economic activity and multipliers when demand for their construction services is increased in a region, but only a small number have an industry that will see significant impacts (outside of the impacts related to spending by construction workers who temporarily locate in the region) from electrical transmission and structures construction. A 2007 report assessing the impacts of investment in the electricity transmission and distribution infrastructure of Connecticut Light and Power (a Northeast Utilities subsidiary) Regional Economic Models Inc. itself makes this point when it notes:

> *"REMI modeled significant increases in employment in the construction sector through the Industry Employment variable. The application of the Industry Employment variable for activity associated with the CL&P [Connecticut Light and Power] investment [in transmission upgrades] allows for an increase in employment without displacing current regional market activity. The decision to model without local competition for labor and market shares was made because the type of investment made is highly specialized."*[18]

This statement acknowledges that electric power line transmission line and structure construction is highly specialized and that it isn't like other construction activity, and that it will not compete with other construction projects for available workers in a region. In that case, an expansion of employment in the construction and repair of electric power lines and structures industry would not occur by drawing on existing workers in a regional labor force, but rather would have to be "imported" (temporarily) into a region to expand the qualified workforce in the region. The differences in regional economic impacts that result from the use of workers from within the region versus the temporary importation of workers is dramatic and discussed more fully later in the following section of this report.

End Notes

[1] Some differences in the models used is discussed in Appendix A: "Analytical Approach and Methodology"
[2] Appendix A provides more detail on the analytical methods used in this report.
[3] Shapiro, Lisa, "*The Northern Pass Tax Impact*." For the Northern Pass, LLC, February, 2011. Accessed online at: http://www.northernpass.us/pdf/NP-TAX-IMPACT-SHEET_3-10-11.pdf
[4] Meals and rooms tax revenues for FY2011 were $235.2 million, thus $779,000/$235,200,000 = .003
[5] The New England Economic Partnership (NEEP) forecasts job growth in NH will average 1.5 Percent between 2010 and 2015. The NEEP forecast was used in this report for the 3rd and 4th years of construction. PolEcon's forecasts NH job growth of 1 percent for 2012. To the extent that our 1 percent forecast is too low, it has the effect of making NPT job impacts appear to be a larger percentage of NH's job growth and thus a more important source of job growth.
[6] U.S Bureau of Labor Statistics " Employment by Industry, Occupation, and Percent Distribution, 2008 and projected 2018".
[7] U.S. Bureau of Labor Statistics Occupational Employment and Wages, accessed online at: http://bls.gov/oes/current/oes499051.htm#ind.
[8] Industry sources indicate towers are typically spaced from 800 to 1,200 feet apart, indicating about 1,000 towers would be needed for the 180 mile line.
[9] Details of the Middletown to Norwalk can be found at Northeast Utilities website here: http://www.transmission-nu.com/residential/projects/middletown/default.asp#timeline.
[10] Black and Veatch, *"High Voltage Direct Current Transmission Study: For United Illuminating Co. and Connecticut Light and Power",* December, 2003.
[11] Energy and Environmental Economics, Inc., *"TEPPC Capital Cost Model"*, prepared for the Western Electricity Coordinating Council, 2010 and 2011 model versions.
[12] NorthStar Economics, Inc., "*The Economic Impact of Electric Power Transmission Line Construction in the Midwest*" 2009, Available at *www.northstar**economic**s.com/ATC%20FINAL%20REPORT.pdf.*
[13] Lantz, E, and Tegen, S.,,"*Jobs and Economic Development from New Transmission in Wyoming*", National Renewable Energy Laboratory of the U.S. Department of Energy, March, 2011.
[14] Black & Veatch, 2003.
[15] More information on IMPLAN is available at www.IMPLAN.com
[16] Tegen, S., Goldberg, M. & Milligan, M., "A User Friendly Tool to Calculate the Economic Impacts From Coal, Natural Gas, and Wind: The Expanded Jobs and Economic Development Impact Model," National Renewable Energy Laboratory of the U.S. Department of Energy, Conference Paper, June 2006.
[17] Regional Economic Models Inc., *"Measuring the Economic Impact of Improved Electricity Distribution in Connecticut,"* for Connecticut Light and Power, July, 2007.
[18] Ibid.